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United States Department of Agriculture,

BUREAU OF ANIMAL INDUSTRY.

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WHITE SNAKEROOT OR RICHWEED (EUPATORIUM URTICÆFOLIUM) AS A STOCK-POISONING PLANT.[1]

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THE CAUSE OF MILK SICKNESS.

Among the suggested causes for the disease popularly known as milk sickness, trembles, slows, tires, etc., has been the plant commonly called "white snakeroot"—*Eupatorium urticæfolium*, or *Eupatorium ageratoides* of the older literature. Many arguments have been advanced both for and against this theory. In later years the possibility of the connection of this plant with the disease has lessened, since Crawford (1908) published his negative pharmacological work, and Jordan and Harris in 1909 published their paper on the *Bacterium lactimorbi*. Although there have been authors who clung to the white snakeroot origin of the disease, it has been believed rather generally that the real cause was not a plant poison but more likely a disease-producing germ.

Somewhat extended experiments upon this subject have been carried on by the United States Department of Agriculture, and though the general results of the experiments in their relation to the disease of milk sickness are not in form for publication, it has been clearly demonstrated that *Eupatorium urticæfolium* must be counted as one of the rather important stock-poisoning plants which produce serious losses of domestic animals. On this account, although the work is incomplete, it seems wise to publish a summary of the results so far as they relate to *Eupatorium urticæfolium* as a poisonous plant, with the hope that some of the losses may be avoided, for it is evident that while in many localities this plant is suspected to be the cause of milk sickness, its importance as a stock-poisoning plant has received little recognition.

DESCRIPTION OF THE PLANT.

Eupatorium urticæfolium Reichard (fig. 1), quoted as *E. ageratoides* L. in the older botanies, is a slender, erect, perennial herb,

[1] Preliminary paper.

belonging to the family Compositæ. Its leaves, which are 3 to 5 inches long, are opposite, broadly ovate, pointed, sharply toothed and

FIG. 1.—White snakeroot or richweed (*Eupatorium urticæfolium*).

thin, and have rather long petioles. The stems are viscid-villous. The small white flowers are in compound corymbs of 8–10 flowers,

appearing in the late summer and fall. The plants are from 1 to 4 feet in height.

It is found widely distributed in the eastern United States and as far west as Minnesota, Oklahoma, Nebraska, and Louisiana. Its favorite habitat is in rich soil of damp woods. It is abundant in the groves along the watercourses of the Middle States and grows with especial profusion in the so-called coves, or damp, shaded ravines, of the northern slopes of the Southern Appalachians. It is by no means, however, confined to shaded situations, for it sometimes grows in masses on cleared hillsides in the open.

It is most commonly known as white snakeroot. Other names which have been applied to it are white sanicle, Indian sanicle, deerwort, boneset, poolwort, poolroot, richweed, squawweed, white top, and steria.

The common thoroughwort, *Eupatorium perfoliatum* L., which grows in similar localities, but usually on soils with more moisture, is readily distinguished from *E. urticæfolium*, as it is a coarser plant and the leaves are long, narrow, rugrose, and, as the name indicates, are without petioles and united around the stem.

EFFECTS OF EUPATORIUM POISONING.

The most noticeable symptom and perhaps the most typical is trembling, which is seen especially in the muscles about the nose and in those of the legs. This becomes marked after exercise, and may be violent, ending in the animal falling to the ground. In some cases trembling is the first symptom noted, but in others there is a preceding period of marked depression and inactivity.

Most cases are constipated and some have bloody feces.

Generally when fed intensively the animals are nauseated, and this is sometimes accompanied with vomiting.

The respiration is normal except that it is quickened and somewhat labored during exertion.

In the average of cases there are no significant changes in temperature.

Weakness is very pronounced. The animals have difficulty in standing, and sometimes remain down for a prolonged period before death. Sometimes the animals live several days after the appearance of the first symptoms.

It will be noticed that these symptoms correspond very closely to those popularly considered typical of milk sickness.

The autopsies are characterized by a congested small intestine and an abnormal condition of the liver.

ANIMALS SUSCEPTIBLE TO EUPATORIUM POISONING.

The authors' experiments were with cattle and sheep. Definite feeding experiments made by others have proved the toxicity of Eupatorium for horses, and extracts from the plant have poisoned cats, dogs, and guinea pigs. So far as reported experimentation goes, it appears that no animals are immune to the toxic principle of the plant. In regard to man the definite evidence is hardly conclusive, in spite of a number of instances in which the plant or an extract is said to have been poisonous. Some of these cases are clearly apocryphal. But, on the whole, there seems to be little doubt that human beings may be poisoned by the plant.

TOXICITY OF THE PLANT.

There is very little difference between the toxic and lethal doses, as determined by experiment. This does not mean that no poisoned animals recover, but does show the serious character of cases of poisoning. Generally speaking, the fatal dose for sheep is about 6 per cent of the animal's weight, and for cattle about 10 per cent. Sheep, consequently, are somewhat more susceptible than cattle.

Although there is some evidence that the toxic dose is smaller when the material is given in a short time, this difference is comparatively slight. It appears from the experimental cases that the elimination of the toxic substance takes place very slowly, so that there is a distinct cumulative effect. This was evident both in the cattle and in the sheep.

The plant is poisonous when dried, but it does not have as much effect as when in a fresh state, so that while Eupatorium in hay may be poisonous it is not so dangerous as the fresh plant.

So far as experimental work has gone, it seems quite clear that the flesh of poisoned animals is not harmful to other animals that may eat it.

Poisoning by Eupatorium is produced by a poisonous principle in the plant, and not by disease germs carried by the plant to the animals.

RELATIONSHIP BETWEEN EUPATORIUM POISONING AND MILK SICKNESS.

There is no question but that *Eupatorium urticæfolium* is poisonous and produces a line of symptoms closely resembling those said to be typical of milk sickness in cattle and other animals. Most cases of the so-called milk sickness in cattle occur in localities where this plant grows. Field cases seen by the authors have the same symptoms as those which have been observed in experimental animals, and have been diagnosed as intoxication by *Eupatorium urticæfolium*. There seems little doubt that many if not most cases of milk sick-

ness or trembles in cattle are caused by this plant. It does not follow, however, that all cases of milk sickness are produced by Eupatorium.

Somewhat extended bacteriological investigations by the authors, the results of which will be published in another paper, appear to substantiate the claim of Jordan and Harris that there is a bacterium widely disseminated in the soil and on plants, which, under certain conditions, for the most part unknown, produces a disease in man and animals in which symptoms are exhibited which appear to be those of milk sickness.

Very much more work is necessary in order to clear up the subject, but it seems highly probable at this stage of the investigation that under the term "milk sickness" or "trembles" are included at least two distinct things, one the poisoning of animals by *Eupatorium urticæfolium* and the other a bacterial disease to which both animals and man are susceptible.

The question of the difference between the two diseases will be discussed later in the detailed report of the investigations. It may be noted here, however, that trembling appears to be more distinctly characteristic of Eupatorium poisoning, and that a subnormal temperature is one of the distinctive symptoms of the bacterial disease, whereas Eupatorium poisoning produces no distinct effect on the temperature.

CONDITIONS UNDER WHICH ANIMALS MAY BE POISONED.

It is known that stock may be pastured where *E. urticæfolium* is abundant and that the use of these pastures may be continued for years, with no harm. Most of the cases of poisoning occur in the late summer and fall and generally in years when there is a deficiency of moisture and a consequent shortage of forage grasses. Cases also occur when grazing animals are confined to a limited area on which the plant is abundant. The experimental work shows that *E. urticæfolium* is not palatable to domestic animals and that they will avoid it in the presence of other foods. As in the case of most stock-poisoning plants, there is a direct relation between shortage of feed and cases of poisoning, although, of course, sporadic cases may occur under other conditions.

REMEDIES.

Sick animals should be treated with remedies to relieve the constipation and increase elimination. To this end purgatives may be used, of which perhaps Epsom salt is the best; this should be used in doses of 1 pound for a 1,000-pound animal. The feed should be laxative, like bran, oil meal, etc. In parts of North Carolina it is

customary to feed "milk-sick" animals with green corn and pumpkins, and there is good reason to consider this a desirable diet.

Inasmuch as the toxic substance of the plant is eliminated very slowly, quick recovery must not be expected, and the animals should be given somewhat prolonged attention.

PREVENTION.

In many places "milk-sick" areas have been fenced off, with consequent prevention of losses. In some localities where *Eupatorium urticæfolium* is particularly abundant this evidently is advisable. Clearing of land and seeding to corn, grain, or grasses will of course stop the trouble. It has long been known that "trembles" affects animals pastured on unbroken land and that the disease disappears after cultivation.

So far as getting rid of the plant is concerned, however, it must be remembered that partial clearing is not sufficient. It is true that the plant favors damp and shaded places, but it sometimes grows most luxuriantly on partially cleared land. It has been noticed in the mountains of North Carolina that the plant increases enormously in cleared land and only disappears after the land has been seeded down. When the poisonous character of the plant is recognized much can be accomplished by so handling the animals that they do not graze largely in areas where it is particularly abundant.

In this connection it may be noted that inasmuch as it takes a fairly large quantity to poison an animal, little harm will result from eating the plant for a short time unless the animal is unusually hungry. Poisoning is more likely to follow from continued feeding as a result of which the toxic substance has a chance to accumulate in the system.

SUMMARY.

1. *Eupatorium urticæfolium* has for some years been considered by many people the cause of milk sickness in cattle.

2. Experimental work shows conclusively that the plant is toxic and produces a definite line of symptoms bearing a close resemblance to those considered characteristic of trembles.

3. Probably many, possibly most, cases of trembles in cattle and sheep are due to poisoning by *E. urticæfolium*.

4. Under the term "milk sickness" or "trembles" are probably grouped at least two distinct things—(1) poisoning by *E. urticæfolium*, and (2) a bacterial disease.

5. Losses of live stock should be avoided by prevention rather than by reliance upon remedies.

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